

# PATENT ABSTRACTS OF JAPAN

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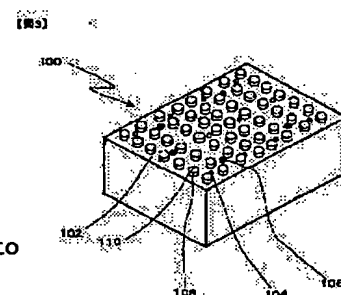
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## (54) COATING METHOD AND COATING EQUIPMENT AND METHOD FOR COLOR FILTER MANUFACTURING AND MANUFACTURING EQUIPMENT

(57)Abstract:

**PROBLEM TO BE SOLVED:** To make possible high quality faultless coating caused by an insufficient degree of adhesion of sucker to substrate and reduction of cost by increasing productivity of die coater to shorten tact time which can be achieved by shorten the film peeling time absorbed substrate from sucker after coating and the absorption time of substrate to the sucker before coating with die coater.

**SOLUTION:** It is a coating method to supply coating liquid to coating equipment and discharge coating liquid to coating member to be worked whose coating liquid is absorbed and hold in the sucker, and to form coating film on the said coating member to be worked by transfer at least either the said coating equipment or the said coating member to be worked relatively. It is a characterized coating method to coat coating liquid by providing a prong on the surface of the coating member to be worked and the top surface of prong becomes contact surface with the coating member to be worked.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The method of application characterized by preparing and applying to the coated member installation side of said adhesive disk the projection from which a summit side turns into the contact surface with said coated member in the method of application which supplies coating liquid to an applicator, is made to move relatively either [ at least ] said applicator or a coated member to the coated member by which adsorption maintenance was carried out in coating liquid at the adhesive disk with discharge from the delivery of an applicator, and forms a paint film on said coated member.

[Claim 2] The method of application according to claim 1 characterized by making the rate of surface ratio occupied to the coated member installation side of said adhesive disk of said projection 10 – 80%.

[Claim 3] Coating liquid to the coated member by which supplied coating liquid to the applicator and adsorption maintenance was carried out from the delivery of an applicator at the adhesive disk with discharge In the method of application which is made to move relatively either [ at least ] said applicator or a coated member, and forms a paint film on said coated member The method of application characterized by setting surface roughness of 5–40mm and said coated member installation side to maximum height  $R_{max}=1-10$ micrometer, and applying the arrangement pitch of the attraction hole in the coated member installation side of said adhesive disk.

[Claim 4] The manufacture approach of the light filter characterized by manufacturing a light filter using the method of application according to claim 1 to 3.

[Claim 5] The coater characterized by to prepare the projection to which a summit side turns into the contact surface with said coated member in the coated member installation side of said adhesive disk in the coater equipped with the migration means to which at least one side of a supply means supply coating liquid, the applicator which has a delivery for carrying out the regurgitation of the coating liquid supplied from the supply means, the adhesive disk which carries out adsorption maintenance of the coated member, and an applicator or an adhesive disk is moved relatively.

[Claim 6] The rate of surface ratio occupied to the coated member installation side of said adhesive disk of said projection is a coater according to claim 5 characterized by being 10 – 80%.

[Claim 7] A supply means to supply coating liquid, and the applicator which has a delivery for carrying out the regurgitation of the coating liquid supplied from the supply means, In the coater equipped with the migration means to which at least one side of the adhesive disk which carries out adsorption maintenance of the coated member with an attraction hole, and an applicator or an adhesive disk is moved relatively the arrangement pitch of the attraction hole in the coated member installation side of said adhesive disk — the surface roughness of 5–40mm and said coated member installation side — maximum height  $R_{max}=$  — the coater which comes out and is characterized by 1–10 micrometers of a certain things.

[Claim 8] The manufacturing installation of the light filter characterized by having one of coaters according to claim 5 to 7, and manufacturing a light filter.

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[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of a light filter and manufacturing installation which are used for the manufacture fields, such as for example, the light filter for color liquid crystal displays, a plasma display, a light filter, a printed circuit board, an integrated circuit, and a semi-conductor, and used these approaches and equipment for the method of application and the coater list which form a paint film in that front face for coating liquid with discharge to coated members, such as a glass substrate of a light filter, especially.

[0002]

[Description of the Prior Art] after the light filter for color liquid crystal displays has the fine grid pattern in three primary colors on the glass substrate and forms the paint film on a glass substrate with such a black grid pattern in the shape of a grid -- between grids -- red, blue, and a green paint film -- FOTORISO -- in law, sequential formation is carried out and it is obtained.

[0003] So, sequential spreading of black, red, blue, and the green coating liquid is carried out on a glass substrate, and the formation process which forms the paint film becomes indispensable at manufacture of a light filter. Although a spinner, bar coater, or a roll coater was used conventionally, in order to reduce consumption of coating liquid and to plan the object disposition top of a paint film as a coater for this paint film formation, if it continues till recent years, die coater is used increasingly.

[0004] As for this kind of die coater, that example is indicated by JP,6-339829,A. This well-known die coater is equipped with the adhesive disk which can reciprocate, and the spreading head which allotted the delivery of the shape of a long and slender rectangle downward. Adsorption maintenance of a substrate is enabled by making an adhesive disk top face into an adsorption side by preparing the attraction hole in the top face of the adhesive disk which is the field in which the substrate which is a coated member is laid, and drawing in from here. And after adsorption maintenance of the glass substrate is carried out on an adhesive disk, it can follow on a glass substrate moving directly under a spreading head with an adhesive disk, coating liquid can be made to be able to breathe out from the delivery of a spreading head, and a paint film can be continued and formed on a glass substrate. Since spreading of precision with the high one where surface height fluctuation of a substrate is smaller can be performed at this time, as shown in JP,12-126668,A, the wave of a substrate of the front face of an adsorption side is small, and it is necessary to carry out adsorption adhesion uniformly for the adhesive disk with which the attraction hole has moreover been arranged in the proper pitch. In a terminal point location, adsorption after a halt is canceled, and the substrate which formation of a paint film completed exfoliates from an adhesive disk top face, and is transported to the following process.

[0005]

[Problem(s) to be Solved by the Invention] When a light filter etc. applies the die coater mentioned above to the actual production process which applies to a glass substrate, the tact time applied to one substrate is shortened, and to reduce raising and cost is strongly desired in productivity.

[0006] In order to shorten a tact time, it is most effective to raise a spreading rate, but since a limitation becomes settled naturally from spreading conditions, such as the physical properties of

coating liquid, and spreading thickness, it is necessary to aim at time amount compaction in parts other than this. If operation analysis is performed, it would be alike unexpectedly and the process which adsorbs a substrate before spreading to an adhesive disk, and the process which exfoliates after applying the substrate to which it stuck will have required time amount.

[0007] About adsorption of a substrate, the part with the attraction hole of an adsorption side is stuck with a substrate by short time amount. However, in a part without an attraction hole, by the time an attraction exhaust speed becomes very small and a substrate sticks to an adsorption side thoroughly because the conductance of attraction exhaust air becomes [ that an attraction hole is closed with a substrate, and ] small since the clearance between a substrate and an adsorption side is small, most time amount will be taken. Even if it uses the big vacuum pump of exhaust air capacity here, or it enlarges the conductance of intermediate piping and even an attraction hole enlarges the exhaust speed of attraction, the small conductance to a substrate is restrained after an attraction hole, and it is not connected with time amount compaction until it sticks a substrate to an adsorption side. Therefore, in a part without an attraction hole, adhesion to the adsorption side of a substrate will be performed gradually, and the top face of a substrate descends gradually per mum in the meantime. If it applies in such the unstable condition, by thickness fluctuation of an attraction hole pitch, spreading unevenness will occur depending on coating liquid, and debasement will be caused.

[0008] Moreover, while being introducing the compressed air into the part which serves as negative pressure for substrate adsorption, and making it the pressure more than atmospheric pressure and canceling adsorption, positive pressure is added to a substrate from an attraction hole, and the substrate which had adhered to the table top also with static electricity besides adsorption power exfoliates as adsorption of the applied substrate is canceled and exfoliating from a table top face is shown in JP,9-192567,A etc. Although the substrate should be able to exfoliate from the table in the phase in which the substrate made suction force the atmospheric pressure if the table was adsorbed only with the suction force, actually, the substrate is stuck to the table also according to electrostatic force, and if there is no positive pressure addition from adsorption, exfoliation of a substrate cannot be performed. What is necessary is just to make the pressure of the compressed air to introduce high for that purpose, although it is necessary to shorten time amount which returns negative pressure to positive pressure, and to generate the force simultaneously higher than the adhesion force by electrostatic force for a short time in order to shorten time amount which exfoliation of a substrate takes here. A substrate moves in the direction of arbitration on the table top face at exfoliation and coincidence, exfoliation time amount becomes short so that a pressure is high to be sure, but trouble may be caused to next substrate migration, or when excessive, it may fall from a table top. Therefore, the technique which shortens time amount for exfoliating a substrate without making the pressure of the compressed air high, in order to regulate free migration of a substrate at the time of exfoliation is needed.

[0009] The place which this invention was made based on the above-mentioned situation, and is made into that object By shortening adsorption time amount until it sticks a substrate to an adhesive disk before spreading, and exfoliation time amount until it exfoliates from an adhesive disk after applying the substrate to which it stuck by die coater While shortening a tact time, raising the productivity in die coater and enabling cost reduction-ization It is in offering the manufacture approach of a light filter and manufacturing installation which used these equipments and an approach for the method of application which enables spreading of high quality without the spreading fault generated by the adhesion imperfection to the adhesive disk of a substrate and the coater, and the list.

[0010]

[Means for Solving the Problem] The above-mentioned object is attained by this invention.

[0011] Coating liquid to the coated member by which the 1st method of application of this invention supplied coating liquid to the applicator, and adsorption maintenance was carried out from the delivery of an applicator at the adhesive disk with discharge Either [ at least ] said applicator or a coated

member is moved relatively, and it is characterized by \*\*\*\*\* which prepares and applies to the coated member installation side of said adhesive disk the projection to which a summit side turns into the contact surface with said coated member in the method of application which forms a paint film on said coated member. It is desirable to make the rate of surface ratio occupied to the coated member installation side of said adhesive disk of said projection 10 – 80% here.

[0012] Coating liquid to the coated member by which the 2nd method of application of this invention supplied coating liquid to the applicator, and adsorption maintenance was carried out from the delivery of an applicator at the adhesive disk with discharge In the method of application which is made to move relatively either [ at least ] said applicator or a coated member, and forms a paint film on said coated member It is characterized by setting surface roughness of 5–40mm and said coated member installation side to maximum height  $R_{max}=1-10$ micrometer, and applying the arrangement pitch of the attraction hole in the coated member installation side of said adhesive disk.

[0013] The manufacture approach of the light filter of this invention manufactures a light filter using one of the above-mentioned methods of application.

[0014] The applicator which has a delivery for the 1st coater which becomes this invention to carry out the regurgitation of the coating liquid supplied from a supply means to supply coating liquid, and the supply means, In the coater equipped with the migration means to which at least one side of the adhesive disk which carries out adsorption maintenance of the coated member, and an applicator or an adhesive disk is moved relatively, it is characterized by preparing the projection to which a summit side turns into the contact surface with said coated member in the coated member installation side of said adhesive disk. Here, as for the rate of surface ratio occupied to the coated member installation side of said adhesive disk of said projection, it is desirable that it is 10 – 80%.

[0015] The applicator which has a delivery for the 2nd coater which becomes this invention to carry out the regurgitation of the coating liquid supplied from a supply means to supply coating liquid, and the supply means, In the coater equipped with the migration means to which at least one side of the adhesive disk which carries out adsorption maintenance of the coated member with an attraction hole, and an applicator or an adhesive disk is moved relatively the arrangement pitch of the attraction hole in the coated member installation side of said adhesive disk — the surface roughness of 5–40mm and said coated member installation side — maximum height  $R_{max}=$  — it comes out and is characterized by 1–10 micrometers of a certain things.

[0016] The manufacturing installation of the light filter of this invention manufactures a light filter using one of the above-mentioned coaters.

[0017] Since the projection is prepared in the coated member installation side in which the coated member of an adhesive disk is laid according to the 1st method of application of above-mentioned this invention, and the coater 1) The space of the fixed volume for attraction exhaust air will be prepared between a coated member and a coated member installation side. Adsorption time amount in order that the suction force of fixed attraction displacement may always act on a coated member, until a coated member sticks to an adhesive disk is decreased substantially. 2) While decreasing the electrostatic force generated at the time of coated member adsorption and being able to reduce the adhesion force by static electricity substantially because the touch area of a coated member and an adhesive disk decreases by projection Since touch-area buildup to reservation and substrate of the transit route of the compressed air for exfoliation can be aimed at, the time amount which exfoliates a coated member from an adhesive disk also becomes short substantially, and a tact time can be shortened greatly.

[0018] According to the 2nd method of application and the coater which become above-mentioned this invention, the arrangement pitch of an attraction hole, Since the surface roughness of a coated member installation side is selected proper, 1 attraction and exfoliation force active area increase. 2) Space which serves as a path for attraction exhaust air between a coated member and a coated member installation side, And like [ in \*\* to which the touch area of the 3 coated member and the coated member installation side where the space which serves as a transit route of the compressed air for

coated member exfoliation is secured decreases ] the 1st method of application and a coater, adsorption time amount and exfoliation time amount are decreased, and a tact time can be shortened greatly. Moreover, since adhesion of a coated member and a coated member is performed for a short time even if it is in the situation of having shortened the tact time, which the method of application and a coater can prevent the quality fault generated by applying in the condition inadequate in adhesion. [0019] According to the manufacture approach of the light filter of this invention, and the manufacturing installation, since a light filter is manufactured with the method of application which was excellent in the above, and a coater, the light filter of high quality can be manufactured for the short high productivity of a tact time.

[0020]

[Embodiment of the Invention] Hereafter, 1 desirable operation gestalt of this invention is explained based on a drawing.

[0021] The whole adhesive disk 100 outline perspective view from which the whole coater outline perspective view which drawing 1 requires for this invention, and drawing 2 become the adhesive disk 100 of drawing 1 and the block diagram of the circumference of a slit die 40, and drawing 3 becomes this invention, and drawing 5 are the whole adhesive disk 150 outline perspective views which are another embodiments of this invention.

[0022] Reference of drawing 1 shows the coater \*\*\*\*\* die coater 1 applied to manufacture of the light filter for color liquid crystal displays. This die coater 1 is equipped with the pedestal 2, and the guide grooved rail 4 of a couple is formed on this pedestal 2. In the these guides grooved rail 4 upper part, the adhesive disk 100 which can reciprocate the guide grooved rail 4 top freely horizontally through the slide foot 8 of a couple is arranged. This adhesive disk 100 holds the substrate A which is a coated member. The detailed structure is shown in drawing 3, the lift pin hole 106 to which the attraction hole 104 and the lift pin which is not illustrated frequent the top face 102 is formed, and the projection 108 is formed for \*\*. Since it connects with the source of a vacuum which is not illustrated, the attraction hole 104 will carry out adhesion maintenance of the substrate A by the suction effect in the summit side 110 of projection 108. Since the space of fixed magnitude occurs and the attraction exhaust air of Ayr of the part is always carried out through the attraction hole 104 by existence of projection 108 between Substrate A and a top face 102, the suction force in fixed displacement will act on Substrate A, and adhesion to the summit side 110 of projection 108 is attained for a short time. Moreover, the touch area of Substrate A and the summit side 110 of projection 108 can be far made smaller than the area of Substrate A, and can reduce the adhesion force by electrostatic force substantially by this.

Consequently, exfoliation in a short time of the substrate after spreading becomes easy. Since the pressure of the compressed air acts on all the parts that the compressed air passes through the space between Substrate A and a top face 102 in an instant, and do not touch the summit side 110 of projection 108 when the compressed air is furthermore spouted from the attraction hole 104 about exfoliation for exfoliation, shortening of exfoliation time amount is further accelerated by this.

[0023] The height of projection 108 is 20 micrometers – 300 micrometers more preferably 10 micrometers – 1mm. If this height is lower than 10 micrometers, while the space between Substrate A and a top face 102 will become small too much, and the conductance for attraction exhaust air will become small and being unable to shorten adhesion time amount to the summit side 110 of Substrate A, Substrate A also comes to contact a top face 102 in addition to summit side 110, and cannot achieve the object of decreasing a touch area for electrostatic force reduction. When the height of projection 108 is higher than 1mm, the leakage close comes so much at the time of adsorption, and it becomes impossible moreover, for Ayr to adsorb a substrate by predetermined vacuum pressure. moreover, the thing for which the rate of surface ratio which the arrangement pitch of projection 108 is 200 micrometers – 5mm more preferably 100 micrometers – 30mm, and is occupied on the top face 102 of the summit side 110 of projection 108 is made 10 – 80% — things are desirable. If the rate of surface ratio is smaller than 10%, the pitch of projection 108 will become large, a substrate will be bent by

vacuum pressure at the time of adsorption, the flatness of a substrate falls, and spreading unevenness arises at the time of spreading, and when the rate of surface ratio is conversely larger than 80%, the touch area of a substrate becomes large and it becomes impossible to reduce the adhesion force by electrostatic force.

[0024] About the configuration of the summit side 110, although circular, a triangle, a square, a polygon, and what kind of thing may be used, it is still more desirable to make [ the ease of a fabrication to whose diameter is  $\phi 0.1$ – $\phi 10$ mm ] it circular.

[0025] Moreover, although the adhesive disk 100 shown in drawing 3 formed the projection 108 over the top-face 102 whole surface, as shown in drawing 5 , it may be the adhesive disk 150 which limited forming projection 108 to the field of an area smaller than Substrate A, and allotted the flat-surface section 160 of the same height as the summit side 110 to the perimeter of the field. In this case, since the perimeter part of Substrate A contacts the flat-surface section, even if this carries out an operation of a cover and adsorbs Substrate A, leakage does not require Ayr from a perimeter.

[0026] shaping there is especially no definition about the shaping approach of the projection 108 to an adhesive disk 100, and according to the cut of garbages other than a projection, and FOTORISO — although there is shaping according to the cave-in of parts other than a projection by shaping by etching using law etc. and sandblasting etc., it is comparatively simple and it is desirable to use the shaping approach by etching also with low cost. Moreover, when the construction material of an adhesive disk also takes workability and endurance into consideration, stones, such as metals, such as stainless steel, iron, and aluminum, and granite, are desirable.

[0027] If drawing 1 is referred to again, between the guide grooved rails 4 of a couple, 14, 16 and 18 which constitute the feed screw device shown in drawing 2 , and the casing 12 which builds this in are arranged, and casing 12 is prolonged along with the guide grooved rail 4. It is thrust into the connector 16 of the shape of a nut fixed to the underside of a stage 6, and further, the feed screw 14 which consists of a ball screw shown in drawing 2 penetrates this connector 16, is prolonged, and the feed screw device is supported free [ a revolution ] by the bearing which those both ends do not illustrate. And AC servo motor 18 is connected with the end of the feed screw 14. In addition, the opening is omitted by drawing 1 , although opening is formed in the top face of casing 12 so that migration of a connector 16 may not be barred.

[0028] If drawing 1 is furthermore seen, the die stanchion 24 which makes an inverted-L character form in the center mostly is arranged on the top face of a pedestal 2. The head of the die stanchion 24 is above the reciprocation path of an adhesive disk 100, and the elevator style 26 is attached. The elevator style 26 is equipped with the rise-and-fall bracket (not shown) which can go up and down. This rise-and-fall bracket is guided in the vertical direction by the guide rod of the couple in casing 28, engages with the ball screw located between guide rods, and is driven free [ rise and fall ] by AC servo motor 30 linked to a ball screw. AC servo motor 30 is attached in the top face of casing 28.

[0029] The die holder 32 is attached in the rise-and-fall bracket through the support shaft (not shown). This die holder 32 is horizontally prolonged [ typeface / of KO ] for these guides grooved rail 4 in the upper part of nothing and the guide grooved rail 4 of a couple. The support shaft of a die holder 32 is supported free [ a revolution ] within the rise-and-fall bracket, and, thereby, a die holder 32 can be rotated in a vertical plane with a support shaft.

[0030] It is located above a die holder 32 and the level bar 36 is also being fixed to the rise-and-fall bracket. This level bar 36 is prolonged along with the die holder 32. The linear actuator 38 of an electromagnetic-action mold is attached in the both ends of the level bar 36, respectively. These linear actuators 38 have the flexible rod which projects from the underside of the level bar 36, and these flexible rod touches the ends of a die holder 32, respectively.

[0031] The slit die 40 as an applicator is attached in the die holder 32. The slit die 40 is prolonged at a level with the reciprocation direction of a stage 6 and the direction which intersects perpendicularly, i.e., the longitudinal direction of a die holder 32, and is supported by the die holder 32 at the ends so that

clearly from drawing 1 .

[0032] The slit die 40 has the chlorofluocarbon trip 66 and the rear lip 60 of a long picture block configuration as roughly shown in drawing 2 . These chlorofluocarbon trip 66 and the rear lip 60 are seen in the reciprocation direction of an adhesive disk 100, and are together stretched and put through SIMM forward and backward, and since it is mutually combined with two or more connection bolts which are not illustrated, the delivery 72 which carries out the regurgitation of the coating liquid is formed in the underside 74 of a slit die 40. The delivery 72 is open for free passage to the manifold 62 through the slit 64 of the same width of face as SIMM. This slit 64 and manifold 62 are prolonged at a level with the cross direction of a slit die 40, i.e., the reciprocation direction of an adhesive disk 100, and the direction which intersects perpendicularly. The manifold 62 is always connected to the supply hose 42 of the coating liquid mentioned above through the aisleway (not shown), and, thereby, a manifold 62 can receive supply of coating liquid.

[0033] now, from the slit die 40, it is shown in drawing 2 — as — the supply hose 42 of coating liquid — extending — \*\*\*\* — the head of this supply hose 42 — the electromagnetism of a syringe pump 44 — it connects with the supply port of a change-over valve 46. electromagnetism — the attraction hose 48 is prolonged from the attraction port of a change-over valve 46, and the point of this attraction hose 48 is inserted into the tank 50. In addition, coating liquid 70 is stored in the tank 50.

[0034] The pump section of a syringe pump 44 has taken the gestalt of the pump of a piston mold, and in order to extrude the syringe 80 which stores coating liquid, and its stored coating liquid or to store / discharge coating liquid at reverse, it consists of pistons 52 which carry out attraction/discharging. and electromagnetism — the coating liquid in a syringe 80 is selectively connectable with either the supply hose 42 or the attraction hose 48 in fluid with change actuation of a change-over valve 46. and these electromagnetism — the straight-line drive which a change-over valve 46 and a piston 52 do not illustrate is electrically connected to a computer 54 — having — \*\*\*\* — the control signal from this computer 54 — winning popularity — electromagnetism — the passing speed and the migration location of the change-over direction of a change-over valve 46 and a piston 52 are controlled.

[0035] Furthermore, the computer 54 is connected to the sequencer 56 and adsorption/discharge control unit 250 in order to control adsorption of the substrate A on the adhesive disk 100 besides actuation control of a syringe pump 44, and adsorption discharge. In this, a sequencer 56 carries out sequence control of AC servo motor 18 of the feed screw 14 by the side of an adhesive disk 100, AC servo motor 30 by the side of the elevator style 26, or the actuation of a linear actuator 38. For the sequence control, the signal which shows the operating state of AC servo motors 18 and 30, the signal from the position sensor 58 which detects the migration location of an adhesive disk 100, the signal from the sensor (not shown) which detects the operating state of a slit die 40, etc. are inputted into a sequencer 56. On the other hand, from a sequencer 56, the signal which shows sequence actuation is outputted to a computer 54. In addition, it is also possible to include control by the computer 54 in a sequencer 56.

[0036] If drawing 1 is referred to again, the sensor column 20 which makes an inverted-L character form to a near side rather than the die stanchion 24 is arranged on the top face of a pedestal 2. The head of this sensor stanchion 20 is above the reciprocation path of an adhesive disk 100, and the thickness sensor 22 is attached there through the bracket 21.

[0037] Next, the method of application using the die coater 1 which is the coater of this this invention is explained.

[0038] If the return to origin of each actuation section in the die coater 1 is performed first, an adhesive disk 100 and a slit die 40 will move to the location of standby. At this time, it is already full of coating liquid 70 to a tank 50 – a slit die 40. While having also already ended the so-called degassing activity of turning a slit die 40 upward furthermore, breathing out coating liquid, and discharging residual Ayr of the slit-die 40 interior, a syringe pump 44 also attracts and stores the coating liquid of the specified quantity from a tank 50, and it is standing by in the condition that the regurgitation of the coating liquid



can be carried out always. And while the lift pin which is not illustrated from the lift pin hole 106 goes up in the front face of an adhesive disk 100, it waits to lay Substrate A. Next, a lift pin will be dropped if Substrate A is laid in the apical surface of a lift pin from the loader which is not illustrated. If Substrate A descends by this actuation, attraction will be started from the attraction hole 104 and adsorption immobilization of the substrate A will be carried out in the summit side 110 of projection 108. On the other hand, the substrate thickness of Substrate A is measured by the thickness sensor 22 to adsorption and coincidence, and a slit die 40 is descended so that the path clearance between Substrate A and the underside 74 of a slit die 40 may become the value given beforehand based on the thickness. And the spreading initiation section of Substrate A takes out a command from a computer 54 to a syringe pump 44, when [ of the delivery 72 of a slit die 40 ] it comes just under exactly, actuation of a syringe pump 44 is started, the coating liquid bead C is formed for coating liquid between discharge, and the underside 74 of a slit die 40 and Substrate A from the delivery 72 of a slit die 40, and spreading to Substrate A is started. and if the spreading termination location of Substrate A comes just under the delivery 72 of a slit die 40, while taking out a halt command from a computer 54 to a syringe pump 44 and stopping the regurgitation of the coating liquid from a slit die 40, a slit die 40 is raised and the coating liquid bead C has been left thoroughly.

[0039] These working adhesive disks 100 move continuously, if Substrate A comes to a terminal point location, they will stop, they take out a command from a computer 54 to adsorption/discharge control unit 250, and cancel adsorption of Substrate A. While suspending the attraction actuation for substrate adsorption as the discharge approach of adsorption, the compressed air is sent into an attraction hole predetermined time. And a lift pin is raised, Substrate A is lifted, it exfoliates from an adhesive disk 100 and the substrate A on a lift pin is conveyed at the following process with the unloader which is not illustrated. An adhesive disk 100 returns to a home position after this, with a lift pin projected. On the other hand, when Substrate A stops in a terminal point location, a syringe pump 44 performs attraction actuation from from, and newly makes coating liquid 70 full from a tank 50. Subsequently, it is [ that the following substrate A comes and ] \*\*\*\*\* about waiting and the same actuation.

[0040] Here about adsorption time amount until Substrate A sticks to an adhesive disk 100 by predetermined adsorption power Since attraction exhaust air will always be carried out by projection 108 from the attraction hole 104 through the space of the fixed volume prepared between a top face 102 and Substrate A The suction force of fixed displacement will always act on Substrate A, and adsorption time amount can be far shortened from the conventional thing without projection 108.

[0041] moreover, about the exfoliation time amount from the adhesive disk 100 of Substrate A In order that Substrate A may contact only the summit side 110 of projection 108, the touch area of Substrate A decreases and the adhesion force by static electricity can be reduced, In order that the compressed air for exfoliation from the attraction hole 104 may act on all the parts that pass through the space formed between Substrate A and a top face 102 in an instant, and do not touch the summit side 110 of Substrate A by projection 108, There is such no projection, adhesion by static electricity is large, and time amount required for exfoliation of Substrate A can be far shortened from the conventional thing on which the compressed air acts by the attraction pore. As a result of being able to shorten substantially the above adsorption time amount and exfoliation time amount, when repeating the spreading actuation to the above-mentioned substrate A, the tact time used as the time amount of the round term can be substantially shortened from the conventional thing. Moreover, even if a tact time becomes short the above result, since it completes by time amount far shorter than before and adhesion to the adhesive disk 100 of Substrate A can be applied in the condition at which a substrate did not descend on the adhesive disk but maintained fixed height of having been stabilized, it does not generate the spreading unevenness of an attraction hole pitch, either, but spreading of high quality of it is attained.

[0042] Next, drawing 4 is the whole adhesive disk 200 outline perspective view which becomes another example of this invention.

[0043] There are only the attraction hole 204 and a lift pin hole 206 in the adsorption side 202 of the

substrate A of an adhesive disk 200. The attraction hole 204 is connected with the attraction means which is not illustrated, and attracts Substrate A directly. Moreover, this attraction hole 204 is connected also with the source of a compressed air which is not illustrated, and compression Air which cancels adsorption of Substrate A is also spouted. the bore diameter of an attraction hole — desirable —  $\phi 1\text{--}\phi 10\text{mm}$ , it is more desirable,  $\phi 2\text{--}\phi 6\text{mm}$  and an arrangement pitch are desirable, and it is 10–25mm more preferably 5–40mm. If an attraction hole will approach too much if an arrangement pitch is smaller than 5mm, and a fabrication of an adhesive disk is difficult and conversely larger than 40mm, since attraction / spray area of Air will become small, the time amount which adsorption and exfoliation take becomes large. Therefore, the adsorption area according to the attraction from the attraction hole 204 of Substrate A by making it the above-mentioned proper attraction hole arrangement pitch, While the application-of-pressure area when spouting compression Air from the attraction hole 204, and carrying out adsorption discharge of the substrate A will become suitable and the adsorption time amount of Substrate A becomes short Even if there is adhesion by static electricity, it becomes possible to cut to it inside and to perform exfoliation from the adsorption side 202 of the adhesive disk 200 of the substrate A in a short time to it.

[0044] moreover, the surface roughness of an adsorption side — maximum height  $R_{\text{max}} = 1\text{--}10$  micrometers is more preferably set to  $R_{\text{max}} = 2\text{--}5$ micrometer. If surface roughness is set to 1 micrometers or more, the part which does not contact Substrate A occurs in the adsorption side 202, and it acts as space where it is placed even between Substrates A by the part from the attraction hole 204, and becomes a path as attraction Air from the attraction hole 204, and compression Air for exfoliation, and the adsorption time amount and exfoliation time amount to the adsorption side 202 of Substrate A can be shortened. Moreover, since the touch area of a substrate decreases substantially, when the adhesion force by static electricity also decreases and a substrate is exfoliated, resistance becomes small and contributes to compaction of exfoliation time amount also in this semantics. If surface roughness becomes larger than 10 micrometers, the wave on the adsorption side of a substrate will become large, and the homogeneity of spreading and rapidity will be lost.

[0045] In addition, the above-mentioned surface roughness means the depth of the microscopic irregularity of the adsorption side used as a front face, and the definition and measuring method are specified to JISB601. In addition, if it sees microscopically, thing \*\* excluding the component of microscopic irregularity from the wave of the irregular front face itself or the wave of the front face itself is called flatness or display flatness, and surface roughness is distinguished clearly.

[0046] By combining the arrangement pitch and surface roughness of the attraction hole shown above, the synergistic effect of each effectiveness enables it to shorten adsorption time amount and exfoliation time amount more.

[0047] Therefore, since the adsorption time amount to the adhesive disk 200 of Substrate A and the exfoliation time amount from an adhesive disk 200 can be shortened substantially, the activity of an adhesive disk 200 enables it to also shorten the tact time of spreading substantially. Moreover, even if it is in the situation of having shortened the tact time, as a result of performing adhesion to the adhesive disk 200 of Substrate A for a short time, it can apply, where a substrate is stabilized in the vertical direction on an adhesive disk, and high quality without quality faults, such as spreading unevenness, can be applied.

[0048] In addition, 800hPa of pressures of the compressed air for 100 to 400hPa and substrate exfoliation of the suction force for adsorption of a substrate is 0.2–0.5MPa more preferably 1 MPa in 0.1 from 50.

[0049] Moreover, as an approach of forming the surface roughness of the adsorption side 202 of an adhesive disk 200 in maximum height  $R_{\text{max}} = 1\text{--}10$ micrometer, there are an approach of making predetermined surface roughness by polish and lap processing, an approach polish, a lap, etc. adjust the concavo-convex depth after forming irregularity in an adsorption side with sandblasting etc., etc. Stones, such as metals, such as stainless steel, iron, and aluminum, and granite, as well as [ still / as

construction material of an adhesive disk 200 ] an adhesive disk 100 are more desirable than workability and endurance.

[0050] In addition, although it is desirable from spreading nature that viscosity is 10cps – 50000cps desirably, and is Newtonian 1cps – 100000cps as coating liquid which can apply this invention, it is applicable also to the coating liquid which has thixotropy. Moreover, it is not dependent on especially the rate of drying of coating liquid, and this invention can be applied to the tact-time compaction when applying by die coater also to a resist besides the coating liquid for red, green, and blue (RGB) colors, and O/C material. As a coated member which is a substrate, metal plates, such as aluminum, a ceramic plate, a silicon wafer, etc. may be used other than glass. For path clearance, as a spreading condition furthermore used, 40–500 micrometers of 50–1000 micrometers of 5–400 micrometers of 100–600 micrometers and spreading thickness of the lip gap of 0.5m a part for /–, and 6m a part for /and a die are [ 80–300 micrometers and a spreading rate ] 20–250 micrometers by part [ for 0.1m/– ], and 10m/more preferably.

[0051] Moreover, as for this invention, the diagonal die length can demonstrate the effectiveness well with a substrate with a size of 500mm or more.

[0052]

[Example] In the 1360x465mm of examples, on an alkali-free-glass substrate with a thickness of 0.7mm A pitch crosswise [ of a substrate ] at the longitudinal direction of 254 micrometers and a substrate 85 micrometers, [ a pitch ] Line breadth created the black matrix film with which thickness is set to 1 micrometer in the grid configuration from which the die length of 4800 (substrate longitudinal direction)x1200 (substrate cross direction) and a vertical angle becomes [ 20 micrometers and the number of RGB pixels ] 20 inches (it is 406mm to 305mm and a substrate longitudinal direction in the substrate cross direction). Protection-from-light material and polyamic acid were used for the black matrix film for the titanate-acid nitride as a binder.

[0053] Then, by wet washing, mixture of a binder, gamma-butyrolactone, a N-methyl-2-pyrrolidone, and 3-methyl-3-methoxybutanol was used as the solvent, the pigment red 177 was used as the pigment, polyamic acid was mixed at 10% of solid content concentration after removing the particle on a substrate, and the coating liquid of R color which adjusted viscosity to 50cps further was applied to whole surface homogeneity by part for 3m/in rate by the thickness of 20 micrometers at die coater. Here, as for the slit die of die coater, the gap of a slit was [ the width of face of 100 micrometers and a slit of the path clearance of the underside of 305mm and a slit die and a substrate ] 100 micrometers. The projection whose diameter is 2mm and whose height is 30 micrometers at an adhesive disk used that in which the adhesive disk transit direction and the cross direction are arranged in 3mm pitch, and the attraction hole with a diameter of 2mm is further prepared in 50mm pitch. And the adsorptive pressure force to the adhesive disk of a substrate was set to 100hPa, and the pressure of the compressed air sent in for the adsorption discharge after spreading was set as 0.2MPa(s). The exfoliation time amount in which adsorption time amount until an adhesive disk is adsorbed by 200hPa of allowance adsorptive pressure force in a substrate spouts the compressed air of 0.2MPa for 1 second, and a substrate exfoliates from an adhesive disk by the above adsorption and the adsorption discharge approach was 0.5 seconds, and the tact time was 29 seconds.

[0054] Now, it dried at 100 degrees C for 20 minutes with the dryer with which after spreading used the hot plate by die coater, and the 90-degree C hot plate performed exposure, development, and exfoliation for resist liquid of 10% of solid content concentration, and 8% of viscosity after 10-minute desiccation after 10-micrometer spreading, it left the color paint film only to the R pixel section, it heated with the hot plate of 260 degrees for 30 minutes, and the cure was performed.

[0055] Each color paint film was formed for formation of the same color paint film also about G and B color using the same die coater and same spreading conditions as R color, and the other same processes. What made the pigment the pigment blue 15 by the coating liquid of R color, and adjusted viscosity to 50cps at 10% of solid content concentration was used for the coating liquid of what made

the pigment pigment Green 36 by the coating liquid of R color, and adjusted viscosity to 40cps at 10% of solid content concentration, and B color here at the coating liquid of G color.

[0056] And ITO was made to adhere in sputtering finally and the light filter was created. Since there were also no foreign matters, such as an aggregate of a pigment and wear powder, and there was also no spreading unevenness, the chromaticity of the obtained light filter was also uniform over the whole substrate surface, and it was perfect in quality.

[0057] To the adhesive disk which adsorbs the substrate of die coater in the example 1 of the example of comparison 1 above, maximum height  $R_{max}=0.6$ micrometer and an attraction hole with a diameter of 2mm manufactured the light filter on the conditions that the surface roughness of the adsorption side of a substrate is completely the same except the adhesive disk transit direction and the cross direction using what is prepared in 50mm pitch. The exfoliation time amount in which adsorption time amount until the substrate in die coater adsorbs by 200hPa of adsorptive pressure force spouts the compressed air of 0.2MPa(s) after 2.5 seconds and spreading, and a substrate exfoliates was 2 seconds, and the tact time including these was 32 seconds.

[0058] However, since the spreading unevenness equivalent to the pitch of an attraction hole was after spreading, when thickness distribution was measured, there was 0.04-micrometer thickness fluctuation in the pitch of an attraction hole. Although the range of fluctuation of thickness distribution was below an allowed value, spreading unevenness was solved, when attraction time amount was made to increase by 30.5 seconds and it operated in tact-time 60 seconds, since the spreading unevenness in viewing was not canceled.

[0059] The light filter was manufactured on the completely same conditions except using that in which the surface roughness of the adsorption side of a substrate is prepared by  $R_{max}=3$ micrometer with the maximum height, and the adhesive disk transit direction and the cross direction are established for the attraction hole with a diameter of 2mm in 25mm pitch for the adhesive disk which adsorbs the substrate of die coater in the example 1 of the example 2 above. The exfoliation time amount in which adsorption time amount until a substrate adsorbs according to 200hPa of adsorptive pressure force by the die coater at this time spouts the compressed air of 0.2MPa(s) after 1.5 seconds and spreading, and a substrate exfoliates was 1 second, and the tact time including these was 30 seconds. Since there were also no foreign matters, such as an aggregate of a pigment and wear powder, and there was also no spreading unevenness, the chromaticity of the obtained light filter was also uniform over the whole substrate surface, and it was perfect in quality. Moreover, spreading unevenness did not have viewing after intermediate spreading, either.

[0060]

[Effect of the Invention] Since a projection is prepared in the substrate installation side in which the substrate of an adhesive disk is laid according to the method of application and the coater which become this invention 1) Since space of the fixed volume for attraction exhaust air will be made between a substrate and a substrate installation side and the suction force of fixed attraction displacement always acts on a substrate Because the touch area of a coated member and an adhesive disk decreases by two projections by which adsorption time amount until a substrate sticks to an adhesive disk is decreased substantially While decreasing the electrostatic force generated at the time of coated member adsorption and reducing the adhesion force by static electricity substantially Since touch-area buildup to reservation and substrate of the transit route of the compressed air for exfoliation can be aimed at, the time amount which exfoliates a substrate from an adhesive disk also becomes short substantially, and a tact time can be shortened greatly.

[0061] Since the arrangement pitch of the attraction hole of the substrate installation side of an adhesive disk and surface roughness are selected proper according to another method of application which becomes this invention, and the coater 1) Space used as the path for attraction and buildup of exfoliation force active area, and the attraction exhaust air between two substrates and a substrate installation side, And according to an operation of reduction \*\* of the static electricity adhesion force

by reservation of the space used as the transit route of the compressed air for substrate exfoliation, and touch-area reduction with three substrates and a substrate installation side, the adsorption time amount and exfoliation time amount to an adhesive disk of a substrate are decreased, and a tact time can be shortened greatly.

[0062] Moreover, even if it is in the situation of having shortened the tact time, adhesion with a substrate and an adhesive disk is completed for a short time, and since which the method of application and a coater can apply in the condition that there is also no height fluctuation of a substrate, they can prevent generating of quality faults, such as spreading unevenness.

[0063] According to the manufacture approach of the light filter of the above this invention, and the manufacturing installation, since a light filter is manufactured with the outstanding method of application and the coater which can shorten the above-mentioned tact time, it becomes possible to manufacture the light filter of high quality for high productivity.

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#### DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view having shown the die coater of one example roughly.

[Drawing 2] It is the outline block diagram having shown the die coater of drawing 1 also including the supply system of coating liquid.

[Drawing 3] It is the whole outline perspective view showing one embodiment of the adhesive disk which becomes this invention.

[Drawing 4] It is the whole outline perspective view showing another embodiment of the adhesive disk which becomes this invention.

[Drawing 5] It is the whole outline perspective view showing still more nearly another embodiment of the adhesive disk which becomes this invention.

[Description of Notations]

1 Die Coater

2 Pedestal

14 Feed Screw

18 AC Servo Motor

22 Thickness Sensor

40 Slit Die (Applicator)

44 Syringe Pump

50 Tank

54 Computer

62 Manifold

64 Slit

72 Delivery  
100 Adhesive Disk  
102 Top Face  
104 Attraction Hole  
106 Lift Pin Hole  
108 Projection  
110 Summit Side  
150 Flat-Surface Section  
160 Adhesive Disk  
200 Adhesive Disk  
202 Adsorption Side  
204 Attraction Hole  
250 Adsorption/Discharge Control Unit  
A Substrate (coated member)  
C Coating liquid bead

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[Translation done.]

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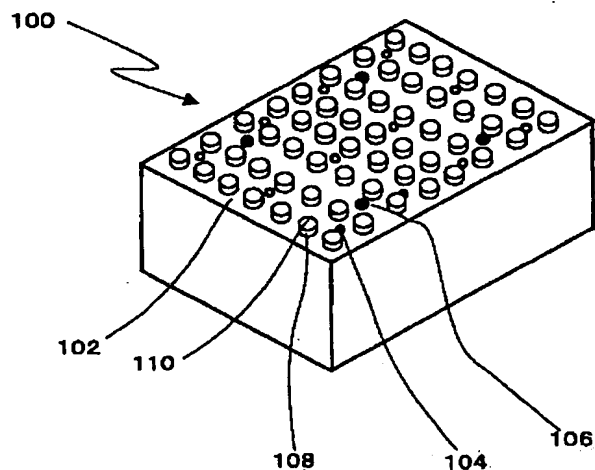
(54) 【発明の名称】 塗布方法および塗布装置並びにカラーフィルターの製造方法およびその製造装置

(57) 【要約】

【課題】 ダイコータで、塗布前に基板を吸着盤に密着させるまでの吸着時間と、吸着した基板を塗布後に吸着盤から剥離するまでの剥離時間を短くすることで、タクトタイムを短縮し、ダイコータでの生産性を向上させてコスト低減化を可能とするとともに、基板の吸着盤への密着不十分により発生する塗布欠点のない高品質の塗布を可能とする。

【解決手段】 塗布器に塗布液を供給し、塗布器の吐出口から塗布液を吸着盤に吸着保持された被塗布部材に吐出しながら、前記塗布器および被塗布部材の少なくとも一方を相対的に移動させて、前記被塗布部材上に塗膜を形成する塗布方法において、前記吸着盤の被塗布部材載置面に、頂上面が前記被塗布部材との接触面となる突起を設けて塗布することを特徴とする塗布方法。

【図3】



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## 【特許請求の範囲】

【請求項1】 塗布器に塗布液を供給し、塗布器の吐出口から塗布液を吸着盤に吸着保持された被塗布部材に吐出しながら、前記塗布器および被塗布部材の少なくとも一方を相対的に移動させて、前記被塗布部材上に塗膜を形成する塗布方法において、前記吸着盤の被塗布部材載置面に、頂上面が前記被塗布部材との接触面となる突起を設けて塗布することを特徴とする塗布方法。

【請求項2】 前記突起の、前記吸着盤の被塗布部材載置面に占める面積比を10～80%にすることを特徴とする請求項1に記載の塗布方法。

【請求項3】 塗布器に塗布液を供給し、塗布器の吐出口から塗布液を吸着盤に吸着保持された被塗布部材に吐出しながら、前記塗布器および被塗布部材の少なくとも一方を相対的に移動させて、前記被塗布部材上に塗膜を形成する塗布方法において、前記吸着盤の被塗布部材載置面にある吸引孔の配置ピッチを5～40mm、および前記被塗布部材載置面の表面粗さを最大高さ $R_{max}=1\sim 10\mu m$ 、にして塗布することを特徴とする塗布方法。

【請求項4】 請求項1～3のいずれかに記載の塗布方法を使用してカラーフィルターを製造することを特徴とするカラーフィルターの製造方法。

【請求項5】 塗布液を供給する供給手段と、供給手段から供給された塗布液を吐出するための吐出口を有する塗布器と、被塗布部材を吸着保持する吸着盤と、塗布器または吸着盤の少なくとも一方を相対的に移動させる移動手段、とを備えた塗布装置において、前記吸着盤の被塗布部材載置面に、頂上面が前記被塗布部材との接触面となる突起を設けたことを特徴とする塗布装置。

【請求項6】 前記突起の前記吸着盤の被塗布部材載置面に占める面積比は10～80%であることを特徴とする請求項5に記載の塗布装置。

【請求項7】 塗布液を供給する供給手段と、供給手段から供給された塗布液を吐出するための吐出口を有する塗布器と、被塗布部材を吸引孔により吸着保持する吸着盤と、塗布器または吸着盤の少なくとも一方を相対的に移動させる移動手段、とを備えた塗布装置において、前記吸着盤の被塗布部材載置面にある吸引孔の配置ピッチが5～40mm、および前記被塗布部材載置面の表面粗さが最大高さ $R_{max}=1\sim 10\mu m$ 、であることを特徴とする塗布装置。

【請求項8】 請求項5～7に記載のいずれかの塗布装置を備えてカラーフィルターを製造することを特徴とするカラーフィルターの製造装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は、例えばカラー液晶ディスプレイ用カラーフィルター、プラズマディスプレイ、光学フィルタ、プリント基板、集積回路、半導体等の製造分野に使用されるものであり、特にカラーフ

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ルターのガラス基板などの被塗布部材に対して、その表面に塗布液を吐出しながら塗膜を形成する塗布方法および塗布装置並びにこれら方法および装置を使用したカラーフィルターの製造方法および製造装置に関する。

## 【0002】

【従来の技術】カラー液晶ディスプレイ用のカラーフィルターは、ガラス基板上に3原色の細かな格子模様を有しており、このような格子模様はガラス基板上に黒色の塗膜を格子状に形成した後に、格子間に赤、青、緑の塗膜をフォトリソ法にて順次形成して得られる。

【0003】それゆえ、カラーフィルターの製造には、ガラス基板上に黒、赤、青、緑の塗布液を順次塗布して、その塗膜を形成していく形成工程が必要不可欠となる。この塗膜形成のための塗布装置としては、従来スピナー、バーコータあるいはロールコータなどが使用されていたが、塗布液の消費を削減し、塗膜の物性向上を図るために、近年に至ってはダイコータが使用されるようになってきている。

【0004】この種のダイコータはその一例がたとえば特開平6-339829号公報に開示されている。この公知のダイコータは往復動可能な吸着盤と、細長い矩形形状の吐出口を下向きに配した塗布ヘッドとを備えている。被塗布部材である基板を載置する面である吸着盤の上面には吸引孔が設けられていて、ここから吸引することにより、吸着盤上面を吸着面として、基板を吸着保持可能としている。そして、吸着盤上にガラス基板が吸着保持された後、吸着盤とともにガラス基板が塗布ヘッドの直下を移動するに伴い、塗布ヘッドの吐出口から塗布液を吐出させて、ガラス基板上に塗膜を連続して形成することができる。この時、基板の表面高さ変動が小さい方が高い精度の塗布ができるので、特開平12-126668号公報に示されるように、基板は吸着面の表面のうねりが小さく、しかも吸引孔が適正なピッチで配置された吸着盤に、均等に吸着密着していることが必要となる。塗膜の形成が完了した基板は、終点位置で停止後、吸着が解除されて吸着盤上面から剥離され、次の工程に移送される。

## 【0005】

【発明が解決しようとする課題】上述したダイコータをカラーフィルター等、ガラス基板に塗布を行う実際の生産工程に適用するにあたっては、一枚の基板に塗布するタクトタイムを短くして生産性を上げ、コストを低減することが強く望まれている。

【0006】タクトタイムを短くするには、塗布速度を向上させるのが最も効果的であるが、塗布液の物性や塗布厚さ等の塗布条件から自ずと限界が定まるので、これ以外の部分での時間短縮を図ることが必要となる。作業分析を行ってみると、思いの外に時間を要しているのが、吸着盤に対して塗布前に基板を吸着する工程と、吸着した基板を塗布後に剥離する工程である。



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【0007】基板の吸着については、吸着面の吸引孔のある部分は短い時間で基板と密着する。しかし吸引孔のない部分では、吸引孔が基板でふさがれることと、基板と吸着面のすきまが小さいために吸引排気のコングダクタンスが小さくなることで、吸引排気速度が非常に小さくなり、基板が完全に吸着面に密着するまでにはかなりの時間がかかることになる。ここで排気能力の大きな真空ポンプを用いたり、途中の配管のコングダクタンスを大きくしたりして、吸引孔まで吸引の排気速度を大きくしても、吸引孔以降基板までの小コングダクタンスが制約とな

って、基板を吸着面に密着させるまでの時間短縮には結びつかない。したがって吸引孔のない部分では、基板の吸着面への密着は徐々に行われることになり、この間基板の上面は $\mu\text{m}$ 単位で徐々に下降する。このような不安定な状態で塗布を行うと、塗布液によっては吸引孔ピッチの膜厚変動によって塗布むらが発生し、品質低下を招く。

【0008】また塗布した基板の吸着を解除して、テーブル上面から剥離することについては、特開平9-192567号公報等に示されているように、基板吸着のために負圧となっている部分に圧縮空気を導入して大気圧以上の圧力にすることで、吸着が解除されるとともに、吸引孔から基板に正圧が付加されて、吸着力の他に静電気によってもテーブル面に付着していた基板が剥離する。基板が吸引力によってのみテーブルに吸着されているのなら、吸引圧を大気圧にした段階で基板はテーブルから剥離できるはずであるが、実際には静電気力によっても基板はテーブルに密着しており、吸着からの正圧付加がないと基板の剥離は行えない。ここで基板の剥離に要する時間を短くするには、負圧を正圧に戻す時間を短くすることと、同時に静電気力による密着力より高い力を短時間で発生させることが必要となるが、そのためには、導入する圧縮空気の圧力を高くすればよい。確かに圧力が高いほど剥離時間は短くなるが、剥離と同時に基板がテーブル上面で任意の方向に移動してしまい、後の基板移送に支障をきたしたり、はなはだしい場合にはテーブル面から落下することがある。したがって、剥離時に基板の自由な移動を規制するために、圧縮空気の圧力を高くしないで、基板を剥離するための時間を短くする技術が必要とされる。

【0009】この発明は、上述の事情に基づいてなされたもので、その目的とするところは、ダイコートで、塗布前に基板を吸着盤に密着させるまでの吸着時間と、吸着した基板を塗布後に吸着盤から剥離するまでの剥離時間を短くすることで、タクトタイムを短縮し、ダイコートでの生産性を向上させてコスト低減化を可能とするとともに、基板の吸着盤への密着不十分により発生する塗布欠点のない高品質の塗布を可能とする塗布方法及び塗布装置、並びにこれら装置及び方法を使用したカラーフィルターの製造方法および製造装置を提供することにあ

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る。

【0010】

【課題を解決するための手段】上記の目的はこの発明によって達成される。

【0011】本発明の第1の塗布方法は、塗布器に塗布液を供給し、塗布器の吐出口から塗布液を吸着盤に吸着保持された被塗布部材に吐出しながら、前記塗布器および被塗布部材の少なくとも一方を相対的に移動させて、前記被塗布部材上に塗膜を形成する塗布方法において、前記吸着盤の被塗布部材載置面に、頂上面が前記被塗布部材との接触面となる突起を設けて塗布することを特徴とする。ここで、前記突起の、前記吸着盤の被塗布部材載置面に占める面積比率を10～80%にすることが好ましい。

【0012】本発明の第2の塗布方法は、塗布器に塗布液を供給し、塗布器の吐出口から塗布液を吸着盤に吸着保持された被塗布部材に吐出しながら、前記塗布器および被塗布部材の少なくとも一方を相対的に移動させて、前記被塗布部材上に塗膜を形成する塗布方法において、前記吸着盤の被塗布部材載置面にある吸引孔の配置ピッチを5～40mm、ならびに前記被塗布部材載置面の表面粗さを最大高さ $R_{\text{max}}=1\sim10\mu\text{m}$ 、にして塗布することを特徴とする。

【0013】本発明のカラーフィルターの製造方法は上記のいずれかの塗布方法を使用してカラーフィルターを製造する。

【0014】本発明になる第1の塗布装置は、塗布液を供給する供給手段と、供給手段から供給された塗布液を吐出するための吐出口を有する塗布器と、被塗布部材を吸着保持する吸着盤と、塗布器または吸着盤の少なくとも一方を相対的に移動させる移動手段、とを備えた塗布装置において、前記吸着盤の被塗布部材載置面に、頂上面が前記被塗布部材との接触面となる突起を設けたことを特徴とする。ここで、前記突起の前記吸着盤の被塗布部材載置面に占める面積比率は10～80%であることが好ましい。

【0015】本発明になる第2の塗布装置は、塗布液を供給する供給手段と、供給手段から供給された塗布液を吐出するための吐出口を有する塗布器と、被塗布部材を吸引孔により吸着保持する吸着盤と、塗布器または吸着盤の少なくとも一方を相対的に移動させる移動手段、とを備えた塗布装置において、前記吸着盤の被塗布部材載置面にある吸引孔の配置ピッチが5～40mm、ならびに前記被塗布部材載置面の表面粗さが最大高さ $R_{\text{max}}=1\sim10\mu\text{m}$ 、であることを特徴とする。

【0016】本発明のカラーフィルターの製造装置は、上記のいずれかの塗布装置を使用してカラーフィルターを製造する。

【0017】上記の本発明の第1の塗布方法、塗布装置によれば、吸着盤の被塗布部材を載置する被塗布部材載

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置面に突起が設けられているのであるから、1) 吸引排気のための一定容積の空間が被塗布部材と被塗布部材載置面の間に設けられることとなり、被塗布部材に常に一定吸引排気量の吸引力が作用するために被塗布部材が吸着盤に密着するまでの吸着時間が大幅に減少させられる、2) 突起によって被塗布部材と吸着盤の接触面積が減少することで被塗布部材吸着時に発生する静電気力を減少させ、静電気による密着力を大幅に低減できるとともに、剥離のための圧縮空気の通過経路の確保と基板への接触面積増大が図れるので、被塗布部材を吸着盤から剥離する時間も大幅に短くなって、タクトタイムを大きく短縮できる。

【0018】上記の本発明になる第2の塗布方法、塗布装置によれば、吸引孔の配置ピッチと、被塗布部材載置面の表面粗さを適正に選定するのであるから、1) 吸引および剥離力作用面積が増大する、2) 被塗布部材と被塗布部材載置面との間に吸引排気のための経路となる空間、及び被塗布部材剥離のために圧縮空気の通過経路となる空間が確保される、3) 被塗布部材と被塗布部材載置面との接触面積が減少する、ので第1の塗布方法と塗布装置と同様に、吸着時間と剥離時間を減少させて、タクトタイムを大きく短縮できる。また、いずれの塗布方法、塗布装置ともに、タクトタイムを短縮した状況であっても、被塗布部材と被塗布部材の密着が短時間で行われるので、密着不十分な状態で塗布を行うことで発生する品質欠点を防止できる。

【0019】本発明のカラーフィルターの製造方法、製造装置によれば、上記の優れた塗布方法、塗布装置でカラーフィルターを製造するのであるから、高品質のカラーフィルターを、タクトタイムの短い高い生産性で製造することができる。

【0020】

【発明の実施の形態】以下、この発明の好ましい一実施形態を図面に基づいて説明する。

【0021】図1は、この発明に係る塗布装置の全体概略斜視図、図2は図1の吸着盤100とスリットダイ40回りの構成図、図3は本発明になる吸着盤100の全体概略斜視図、図5は本発明の別の実施態様である吸着盤150の全体概略斜視図である。

【0022】図1を参照すると、カラー液晶ディスプレイ用カラーフィルターの製造に適用される塗布装置いわゆるダイコータ1が示されている。このダイコータ1は基台2を備えており、この基台2上には一対のガイド溝レール4が設けられている。これらガイド溝レール4上方には、一対のスライド脚8を介してガイド溝レール4上を水平方向に往復動自在となっている吸着盤100が配置されている。この吸着盤100は被塗布部材である基板Aを保持するものである。その詳細な構造は図3に示すようになっており、その上面102には吸引孔104と図示しないリフトピンが出入するリフトピン穴10

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6が設けられとともに、突起108が設けられている。吸引孔104は図示しない真空源に接続されているから、その吸引作用により基板Aを突起108の頂上面110に密着保持することになる。突起108の存在によって、基板Aと上面102の間に一定の大きさの空間が発生し、その部分のエアーが吸引孔104を介して常に吸引排気されるので、基板Aには一定排気量での吸引力が作用することとなり、短時間で突起108の頂上面110に密着可能となる。また、基板Aと突起108の頂上面110との接触面積は基板Aの面積よりもはるかに小さくすることができ、これによって静電気力による密着力を大幅に減ずることができる。その結果、塗布後の基板の短時間での剥離が容易となる。さらに剥離に関しては、剥離のために吸引孔104から圧縮空気を噴出したときに、基板Aと上面102の間にある空間を圧縮空気が瞬時に通過し、突起108の頂上面110と接触していない部分すべてに圧縮空気の圧力が作用するので、これによってさらに剥離時間の短縮化が加速される。

【0023】突起108の高さは、好ましくは $10\mu\text{m}$ ～ $1\text{mm}$ 、より好ましくは $20\mu\text{m}$ ～ $300\mu\text{m}$ である。この高さが $10\mu\text{m}$ より低いと、基板Aと上面102との間の空間が小さくなりすぎて吸引排気のためのコンダクタンスが小さくなって基板Aの頂上面110への密着時間を短くできないとともに、基板Aは頂上面110以外に上面102にも接触するようになり、静電気力減少のために接触面積を減少させるという目的を果たせない。また突起108の高さが $1\text{mm}$ よりも高いと、吸着時にエアーが多量に漏れ入ってきて、所定の真空圧で基板を吸着できなくなる。また突起108の配置ピッチは好ましくは $100\mu\text{m}$ ～ $30\text{mm}$ 、より好ましくは $200\mu\text{m}$ ～ $5\text{mm}$ であり、突起108の頂上面110の上面102に占める面積比率は $10\sim 80\%$ にすることが好ましい。面積比率が $10\%$ より小さいと、突起108のピッチが大きくなって、吸着時の真空圧で基板がたわんで基板の平面度が低下して塗布時に塗布むらが生じ、逆に面積比率が $80\%$ よりも大きいと、基板の接触面積が大きくなって、静電気力による密着力を減ずることができなくなる。

【0024】さらに頂上面110の形状については、円形、三角形、四角形、多角形といかなるものでもよいが、製作の容易さから、直径が $\phi 0.1\sim\phi 10\text{mm}$ の円形にするのが望ましい。

【0025】また図3に示す吸着盤100は、上面102全面にわたって突起108を設けたが、図5に示すように、突起108を設けるのを基板Aよりも小さな面積の領域に限定し、その領域の周囲には頂上面110と同じ高さの平面部160を配した吸着盤150であってもよい。この場合、基板Aの周囲部分が平面部と接触するので、これがふたの作用をして、基板Aを吸着しても周囲からエアーが漏れはいることはない。

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【0026】吸着盤100への突起108の成形方法については特に限定はなく、突起以外の不要部分の切削による成形、フォトリソ法等を用いたエッチングによる成形、サンドブラストによって突起以外の部分の陥没による成形、等があるが、比較的簡便でコストも低いエッチングによる成形方法を用いるのが好ましい。また、吸着盤の材質も加工性、耐久性を考慮するとステンレス、鉄、アルミ等の金属、グラナイト等の石材が望ましい。

【0027】再び図1を参照すると、一対のガイド溝レール4間には、図2に示す送りねじ機構を構成する14、16、18とこれを内蔵するケーシング12が配置されており、ケーシング12はガイド溝レール4に沿って延びている。送りねじ機構は、図2に示されているボールねじからなるフィードスクリュウ14がステージ6の下面に固定されたナット状のコネクタ16にねじ込まれ、さらにこのコネクタ16を貫通して延びて、その両端部が図示しない軸受に回転自在に支持されている。そしてフィードスクリュウ14の一端にはACサーボモータ18が連結されている。なお、ケーシング12の上面にはコネクタ16の移動を妨げないように開口部が形成されているが、図1にはその開口部が省略されている。

【0028】さらに図1を見ると、基台2の上面にはほぼ中央に逆L字形をなすダイ支柱24が配置されている。ダイ支柱24の先端は、吸着盤100の往復動経路の上方にあって、昇降機構26が取り付けられている。昇降機構26には昇降可能な昇降ブラケット（図示しない）が備えられている。この昇降ブラケットはケーシング28内の一対のガイドロッドで上下方向に案内され、ガイドロッド間に位置するボールねじと係合して、ボールねじに接続するACサーボモータ30で昇降自在に駆動される。ACサーボモータ30はケーシング28の上面に取り付けられている。

【0029】昇降ブラケットには支持軸（図示しない）を介してダイホルダ32が取り付けられている。このダイホルダ32はコの字形をなし、かつ一対のガイド溝レール4の上方をこれらガイド溝レール4間に亘って水平に延びている。ダイホルダ32の支持軸は昇降ブラケット内にて回転自在に支持されており、これにより、ダイホルダ32は支持軸とともに垂直面内で回転することができる。

【0030】昇降ブラケットには、ダイホルダ32の上方に位置して水平バー36も固定されている。この水平バー36はダイホルダ32に沿って延びている。水平バー36の両端部には、電磁作動型のリニアアクチュエータ38がそれぞれ取り付けられている。これらリニアアクチュエータ38は水平バー36の下面から突出する伸縮ロッドを有していて、これら伸縮ロッドはダイホルダ32の両端にそれぞれ接触している。

【0031】ダイホルダ32内には塗布器としてのスリットダイ40が取り付けられている。図1から明らかな

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ようにスリットダイ40はステージ6の往復動方向と直交する方向、つまり、ダイホルダ32の長手方向に水平に延びており、そして、その両端にてダイホルダ32に支持されている。

【0032】スリットダイ40は図2に概略的に示されているように、長尺なブロック形状のフロントリップ66およびリアリップ60を有している。これらフロントリップ66、リアリップ60は吸着盤100の往復動方向でみて前後にシムを介して張り合わされ、図示しない複数の連結ボルトにより相互に結合されているので、スリットダイ40の下面74には塗液を吐出する吐出口72が形成される。吐出口72はシムと同じ幅のスリット64を介して、マニホールド62に連通している。このスリット64とマニホールド62はスリットダイ40の幅方向、すなわち、吸着盤100の往復動方向と直交する方向に水平に延びている。マニホールド62は前述した塗布液の供給ホース42に内部通路（図示しない）を介して常時接続されており、これにより、マニホールド62は塗布液の供給を受けることができる。

【0033】さて、スリットダイ40からは図2に示されているように塗布液の供給ホース42が延びており、この供給ホース42の先端はシリンジポンプ44の電磁切換え弁46の供給ポートに接続されている。電磁切換え弁46の吸引ポートからは吸引ホース48が延びており、この吸引ホース48の先端部はタンク50内に挿入されている。なお、タンク50には塗布液70が蓄えられている。

【0034】シリンジポンプ44のポンプ部はピストン型のポンプの形態をとっており、塗液を貯蔵するシリンジ80とその貯蔵した塗液を押し出したり、逆に塗液を貯蔵／排出するために吸引／吐出動作をするピストン52より構成される。そして電磁切換え弁46の切換え作動により、シリンジ80内の塗液は供給ホース42および吸引ホース48の一方に選択的に流体的に接続可能となっている。そして、これら電磁切換え弁46およびピストン52の図示しない直線駆動機構はコンピュータ54に電氣的に接続されており、このコンピュータ54からの制御信号を受けて、電磁切換え弁46の切換方向、ならびにピストン52の移動速度や移動位置が制御されるようになっている。

【0035】さらに、シリンジポンプ44の作動制御の他、吸着盤100上での基板Aの吸着と吸着解除の制御を行うため、コンピュータ54はシーケンサ56、吸着／解除制御装置250に接続されている。このなかでシーケンサ56は、吸着盤100側のフィードスクリュウ14のACサーボモータ18や、昇降機構26側のACサーボモータ30やリニアアクチュエータ38の作動をシーケンス制御するものである。そのシーケンス制御のために、シーケンサ56にはACサーボモータ18、30の作動状態を示す信号、吸着盤100の移動位置を検

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出する位置センサ58からの信号、スリットダイ40の作動状態を検出するセンサ(図示しない)からの信号などが入力される。一方、シーケンサ56からはシーケンス動作を示す信号がコンピュータ54に出力されるようになっている。なお、シーケンサ56にコンピュータ54による制御を組み込むことも可能である。

【0036】再度図1を参照すると、基台2の上にはダイ支柱24よりも手前側に逆L字形をなすセンサ柱20が配置されている。このセンサ支柱20の先端は、吸着盤100の往復動経路の上方にあって、そこにはブラケット21を介して厚みセンサ22が取り付けられている。

【0037】次にこの本発明の塗布装置であるダイコータ1を使った塗布方法について説明する。

【0038】まずダイコータ1における各作動部の原点復帰が行われると吸着盤100、スリットダイ40はスタンバイの位置に移動する。この時、タンク50へスリットダイ40まで塗布液70はすでに充満されてる。さらにスリットダイ40を上向きにして塗布液を吐出してスリットダイ40内部の残留エアーを排出するという、いわゆるエアー抜き作業も既に終了しているとともに、シリンジポンプ44もタンク50から所定量の塗液を吸引・貯蔵して、いつでも塗液を吐出できる状態で待機している。そして、吸着盤100の表面にはリフトピン穴106から図示しないリフトピンが上昇するとともに、基板Aが載置されるのを待つ。次に、図示しないロードから基板Aがリフトピンの先端面に載置されると、リフトピンを下降させる。この動作により基板Aが下降すると、吸引孔104から吸引を開始して基板Aを突起108の頂上面110に吸着固定する。一方吸着と同時に厚みセンサ22で基板Aの基板厚みを測定し、その厚さに基づき、基板Aとスリットダイ40の下面74との間のクリアランスがあらかじめ与えた値になるように、スリットダイ40を下降する。そして、基板Aの塗布開始部がスリットダイ40の吐出口72のちょうど真下に来たときに、コンピュータ54からシリンジポンプ44に指令を出して、シリンジポンプ44の動作を開始してスリットダイ40の吐出口72から塗布液を吐出し、スリットダイ40の下面74と基板A間に塗布液ビードCを形成して、基板Aへの塗布が開始される。そして、基板Aの塗布終了位置がスリットダイ40の吐出口72の真下にきたら、シリンジポンプ44に対してコンピュータ54から停止指令を出してスリットダイ40からの塗布液の吐出を停止するとともに、スリットダイ40を上昇させて完全に塗布液ビードCをたちきる。

【0039】これらの動作中吸着盤100は動きつづけ、基板Aが終点位置にきたら停止し、コンピュータ54から吸着／解除制御装置250に指令を出して基板Aの吸着を解除する。吸着の解除方法としては、基板吸着のための吸引動作を停止するとともに、吸引孔に圧縮空

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気を所定時間送り込む。そしてリフトピンを上昇させて基板Aを持ち上げて吸着盤100から剥離し、図示されないアンロードによってリフトピン上の基板Aを次の工程に搬送する。この後吸着盤100はリフトピンを突きだしたまま原点位置に復帰する。一方シリンジポンプ44は、基板Aが終点位置で停止した時から吸引動作を行ってタンク50から新たに塗布液70を充満させる。ついで次の基板Aが来るのを待ち、同じ動作をくりかえす。

10 【0040】ここで、基板Aが吸着盤100に所定吸着力で密着するまでの吸着時間については、突起108によって上面102と基板Aとの間に設けられる一定容積の空間を経て、常に吸引孔104から吸引排気されることになるので、基板Aには常時一定排気量の吸引力が作用することとなり、突起108がない従来のものより、はるかに吸着時間を短くすることができる。

【0041】また基板Aの吸着盤100からの剥離時間については、突起108の頂上面110にのみ基板Aが接触するために、基板Aの接触面積が減少して静電気による密着力を低減できることと、吸引孔104からの剥離用圧縮空気が、突起108によって基板Aと上面102の間に形成される空間を瞬時に通過して、基板Aの頂上面110と接触していない部分すべてに作用するため、このような突起がなく静電気による密着が大きく、また吸引孔部分のみ圧縮空気が作用する従来のものより、基板Aの剥離のために要する時間をはるかに短くできている。以上の吸着時間と剥離時間が大幅に短縮できる結果、上記の基板Aへの塗布動作を繰り返すとき、その一周期の時間となるタクトタイムを、従来のものより大幅に短くできる。また以上の結果、タクトタイムが短くなっても、基板Aの吸着盤100への密着は従来よりもはるかに短い時間で完了するため、基板が吸着盤上で下降せず、一定高さを保った安定した状態で塗布が行えるので、吸引孔ピッチの塗布むらも発生せず、高い品質の塗布が可能となる。

【0042】次に図4は本発明の別の実施例になる吸着盤200の全体概略斜視図である。

【0043】吸着盤200の基板Aの吸着面202には、吸引孔204とリフトピン穴206があるだけである。吸引孔204は図示していない吸引手段に連結されており、基板Aを直接吸引する。またこの吸引孔204は図示しない圧空源にも連結されており、基板Aの吸着を解除する圧縮エアーも噴出される。吸引孔の穴径は好ましくは $\phi 1 \sim \phi 10 \text{ mm}$ 、より好ましくは $\phi 2 \sim \phi 6 \text{ mm}$ 、配置ピッチは好ましくは $5 \sim 40 \text{ mm}$ 、より好ましくは $10 \sim 25 \text{ mm}$ である。配置ピッチが $5 \text{ mm}$ より小さいと、吸引孔が接近しすぎて吸着盤の製作が困難であり、逆に $40 \text{ mm}$ よりも大きいと、エアーの吸引／吹きつけ面積が小さくなるので、吸着や剥離に要する時間が大きくなる。したがって上記の適正な吸引孔配置ピッチにする

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ことにより、基板Aの吸引孔204からの吸引による吸着面積や、吸引孔204から圧縮エアーを噴出して基板Aを吸着解除する時の加圧面積が適切なものとなり、基板Aの吸着時間が短くなるとともに、静電気による密着があっても、それにうちかって短時間での基板Aの吸着盤200の吸着面202からの剥離を行うことが可能となる。

【0044】また吸着面の表面粗さは最大高さ $R_{max}=1\sim10\mu m$ 、より好ましくは $R_{max}=2\sim5\mu m$ とする。表面粗さが $1\mu m$ 以上になると、吸着面202に基板Aと接触しない部分が発生し、その部分が吸引孔204から基板Aまでに介在する空間として作用し、吸引孔204からの吸引エアーや、剥離のための圧縮エアーの通り道となり、基板Aの吸着面202への吸着時間や剥離時間を短くすることができる。また実質的に基板の接触面積が減少するので、静電気による密着力も減少し、基板の剥離を行うときに抵抗が小さくなって、この意味でも剥離時間の短縮に貢献する。表面粗さが $10\mu m$ よりも大きくなると、基板の吸着面上でのうねりが大きくなって、塗布の均一性や高速性が失われる。

【0045】なお上記の表面粗さは、表面となる吸着面の微視的な凹凸の深さを意味しており、その定義と測定方法はJISB601に規定されている。なお、微視的にみれば凹凸のある表面自体のうねり、あるいは表面自体のうねりから微視的な凹凸の成分を除いたもの、が平面度、あるいは平坦度と呼ばれるものであり、表面粗さとは明確に区別される。

【0046】上記に示した吸引孔の配置ピッチと表面粗さを組み合わせることで、それぞれの効果の相乗効果により、吸着時間と剥離時間をより短くすることが可能となる。

【0047】したがって吸着盤200の使用によって、基板Aの吸着盤200への吸着時間及び吸着盤200からの剥離時間を大幅に短縮できるので、塗布のタクトタイムも大幅に短縮することが可能となる。また、タクトタイムを短縮した状況であっても、基板Aの吸着盤200への密着が短時間で行われる結果、基板が吸着盤上で上下方向に安定した状態で塗布を行えることとなり、塗布むら等の品質欠点のない高品質の塗布が行える。

【0048】なお基板の吸着のための吸引力は、50から800hPa、より好ましくは100から400hPa、基板剥離のための圧縮空気の圧力は0.1から1MPa、より好ましくは0.2～0.5MPaである。

【0049】また吸着盤200の吸着面202の表面粗さを最大高さ $R_{max}=1\sim10\mu m$ に形成する方法としては、研磨、ラップ加工で所定表面粗さに仕上げていく方法や、サンドブラスト等によって吸着面に凹凸を形成してから研磨、ラップ等で凹凸の深さを調整していく方法等がある。さらに吸着盤200の材質としては、吸着盤100と同じく、加工性及び耐久性より、ステンレ

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ス、鉄、アルミ等の金属、グラナイト等の石材が望ましい。

【0050】なお本発明が適用できる塗布液としては粘度が $1cps\sim100000cps$ 、望ましくは $10cps\sim50000cps$ であり、ニュートニアンであることが塗布性から好ましいが、チキソ性を有する塗液にも適用できる。また塗布液の乾燥速度にも特に依存せず、赤、緑、青(RGB)色用の塗液の他、レジスト、O/C材に対しても、ダイコートで塗布するときのタクトタイム短縮に本発明を適用できる。基板である被塗布部材としてはガラスの他にアルミ等の金属板、セラミック板、シリコンウェハー等を用いてもよい。さらに使用する塗布状態としては、クリアランスが $40\sim500\mu m$ 、より好ましくは $80\sim300\mu m$ 、塗布速度が $0.1m/分\sim10m/分$ 、より好ましくは $0.5m/分\sim6m/分$ 、ダイのリップ間隙は $50\sim1000\mu m$ 、より好ましくは $100\sim600\mu m$ 、塗布厚さが $5\sim400\mu m$ 、より好ましくは $20\sim250\mu m$ である。

【0051】また本発明は対角の長さが500mm以上のサイズの基板でその効果をよく発揮することができる。

【0052】

【実施例】実施例1

360×465mmで厚さ0.7mmの無アルカリガラス基板上に、基板の幅方向にピッチが $254\mu m$ 、基板の長手方向にピッチが $85\mu m$ 、線幅が $20\mu m$ 、RGB画素数が4800(基板長手方向)×1200(基板幅方向)、対角の長さが20インチ(基板幅方向に305mm、基板長手方向に406mm)となる格子形状で、厚さが $1\mu m$ となるブラックマトリックス膜を作成した。ブラックマトリックス膜は、チタン酸窒化物を遮光材、ポリアミック酸をバインダーとして用いたものであった。

【0053】続いてウェット洗浄によって基板上のパーティクルを除去後、ポリアミック酸をバインダー、γ-ブチロラクトン、N-メチル-2-ピロリドンと3-メチル-3-メトキシブタノールの混合物を溶媒、ピグメントレッド177を顔料にして固形分濃度10%で混合し、さらに粘度を50cpsに調整したR色の塗液を、 $20\mu m$ の厚さで速度 $3m/分$ にて、ダイコートで全面均一に塗布した。ここで、ダイコートのスリットダイはスリットの間隙が $100\mu m$ 、スリットの幅が305mm、スリットダイの下面と基板とのクリアランスは $100\mu m$ であった。吸着盤には直径が2mm、高さが $30\mu m$ の突起が、吸着盤走行方向、幅方向ともに3mmピッチで配置されていて、さらに直径2mmの吸引孔が50mmピッチで設けられているものを用いた。そして基板の吸着盤への吸着圧力は100hPaにし、塗布後の吸着解除のために送り込む圧縮空気の圧力は0.2MPaに設定した。以上の吸着及び吸着解除方法で、基板が吸着盤へ許容吸着圧力200hPaで吸着されるまでの吸着時間は1秒、0.2MPaの圧縮空気を噴出して基板が吸着盤

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から剥離される剥離時間は0.5秒であり、タクトタイムは2.9秒であった。

【0054】さてダイコータで塗布後はホットプレートを使用した乾燥装置で100℃で20分乾燥し、固形分濃度10%、粘度8%のレジスト液を10μm塗布後、90℃のホットプレートで10分乾燥後、露光・現像・剥離を行って、R画素部にのみ色塗膜を残し、260度のホットプレートで30分加熱して、キュアを行った。

【0055】同様の色塗膜の形成をG、B色についても、R色と同様のダイコータと塗布条件、その他同じ工程を用いて、それぞれの色塗膜を形成した。ここでG色の塗液には、R色の塗液で顔料をピグメントグリーン36にして固形分濃度10%で粘度を40cpsに調整したもの、B色の塗液には、R色の塗液で顔料をピグメントブルー15にして固形分濃度10%で粘度を50cpsに調整したもの、を用いた。

【0056】そして最後にITOをスパッタリングで付着させ、カラーフィルターを作成した。得られたカラーフィルターは、顔料の凝集物や摩耗粉等の異物もなく、塗布むらもないために色度も基板全面にわたって均一で、品質的に申し分ないものであった。

#### 【0057】比較例1

上記の実施例1でダイコータの基板を吸着する吸着盤に、基板の吸着面の表面粗さが最大高さ $R_{max}=0.6\mu m$ 、直径2mmの吸引孔が吸着盤走行方向、幅方向ともに50mmピッチで設けられているものを用いる以外は、全く同じ条件でカラーフィルターを製造した。ダイコータでの基板が吸着圧力200hPaで吸着されるまでの吸着時間は2.5秒、また塗布後の0.2MPaの圧縮空気を噴出して基板が剥離される剥離時間は2秒で、これらを含めたタクトタイムは3.2秒であった。

【0058】ただし、塗布後に吸引孔のピッチに相当する塗布むらがあったので、膜厚分布を測定すると、吸引孔のピッチで0.04μmの膜厚変動があった。膜厚分布の変動幅は許容値以下であったが、目視での塗布むらが解消されないため、吸引時間を30.5秒までに増加させ、タクトタイム60秒で運転したところ、塗布むらが解消した。

#### 【0059】実施例2

上記の実施例1で、ダイコータの基板を吸着する吸着盤に、基板の吸着面の表面粗度が最大高さで $R_{max}=3\mu m$ で、直径2mmの吸引孔が吸着盤走行方向、幅方向ともに25mmピッチで設けられているものを用いる以外は、全く同じ条件でカラーフィルターを製造した。この時のダイコータで基板が吸着圧力200hPaで吸着されるまでの吸着時間は1.5秒、また塗布後の0.2MPaの圧縮空気を噴出して基板が剥離される剥離時間は1秒で、これらを含めたタクトタイムは3.0秒であった。えられたカラーフィルターは、顔料の凝集物や摩耗粉等の異物もなく、塗布むらもないために色度も基板全面にわ

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たって均一で、品質的に申し分ないものであった。また、途中の塗布後に目視でも、塗布むらはなかった。

#### 【0060】

【発明の効果】本発明になる塗布方法、塗布装置によれば、吸着盤の基板を載置する基板載置面に突起を設けるので、1) 吸引排気のための一定容積の空間が基板と基板載置面の間にできることとなり、基板に常に一定吸引排気量の吸引力が作用するので、基板が吸着盤に密着するまでの吸着時間が大幅に減少させられる、2) 突起によって被塗布部材と吸着盤の接触面積が減少することで、被塗布部材吸着時に発生する静電気力を減少させ、静電気による密着力を大幅に低減するとともに、剥離のための圧縮空気の通過経路の確保と基板への接触面積増大が図れるので、基板を吸着盤から剥離する時間も大幅に短くなって、タクトタイムを大きく短縮できる。

【0061】本発明になる別の塗布方法、塗布装置によれば、吸着盤の基板載置面の吸引孔の配置ピッチと、表面粗さが適正に選定されるので、1) 吸引および剥離力作用面積の増大、2) 基板と基板載置面との間の吸引排気のための経路となる空間、及び基板剥離のための圧縮空気の通過経路となる空間の確保、3) 基板と基板載置面との接触面積減少による静電気密着力の減少、の作用によって、基板の吸着盤への吸着時間と剥離時間を減少させて、タクトタイムを大きく短縮できる。

【0062】また、いずれの塗布方法、塗布装置ともに、タクトタイムを短縮した状況であっても基板と吸着盤との密着が短時間で完了し、基板の高さ変動もない状態で塗布を行えるために、塗布むら等の品質欠点の発生を防止できる。

【0063】以上の本発明のカラーフィルターの製造方法、製造装置によれば、上記のタクトタイムが短縮できる優れた塗布方法、塗布装置でカラーフィルターを製造するのであるから、高い品質のカラーフィルターを高い生産性で製造することが可能となる。

#### 【図面の簡単な説明】

【図1】一実施例のダイコータを概略的に示した斜視図である。

【図2】図1のダイコータを塗布液の供給系をも含めて示した概略構成図である。

【図3】本発明になる吸着盤の一実施態様を示す全体概略斜視図である。

【図4】本発明になる吸着盤の別の実施態様を示す全体概略斜視図である。

【図5】本発明になる吸着盤のさらに別の実施態様を示す全体概略斜視図である。

#### 【符号の説明】

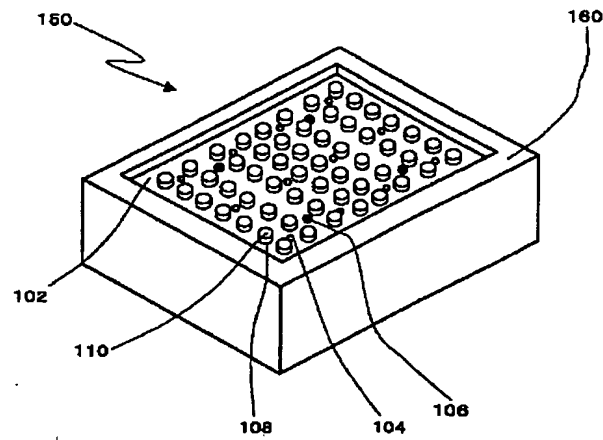
- 1 ダイコータ
- 2 基台
- 14 フィードスクリー
- 18 ACサーボモータ



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【図5】

【図5】



フロントページの続き

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 4F042 AA02 AA07 AA10 BA03 BA08  
 DF09 DF29